NUI Galway
OÉ Gaillimh

Autumn Examinations 2021-2022

Course Instance Code(s)	4BCT1, 4BS2
Exam(s)	4th B.Sc. Computer Science and IT B.Sc. (Hons)
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Paper No.	1
External Examiner(s)	Dr. R. Trestian
Internal Examiner(s)	Professor M. Madden *Dr. C. O'Riordan

Instructions: Answer any three questions. All questions carry equal marks

Duration	2 hours
No. of Pages	3
Discipline(s)	Computer Science
Course Co-ordinator(s)	Dr. C. O'Riordan

Requirements:
Release in Exam Venue Yes [Y] No [ ]

PTO

CT421 Artificial Intelligence

Q.1.

(a) With respect to a suitable game of your choice, show how the *minimax algorithm* can be applied to choose suitable moves to play the game. Your answer should include an explanation as to how to build the game tree and assign values. Discuss the efficiency of the approach and how it could be improved. (12)

(b) The minimax algorithm is often applied in two player games when one can list all game states. Discuss, briefly, how you might extend the approach to deal with scenarios where one cannot enumerate all potential game states. (8)

(c) Explain, with a suitable example, an informed search algorithm (e.g A* algorithm). (7)

Q.2.

(a) With reference to the schema theorem, explain the effects on a population of solutions of:

a) Mutation
b) Crossover
c) Selection (11)

(b) The travelling salesperson problem is a well-studied problem. Given a weighted graph G where non-negative weights are assigned to each edge, the goal is to find the cheapest path that visits each node once.

Explain how you would apply a genetic algorithm to find a good path. Your answer should include a description of suitable fitness function, a suitable representation of the chromosomes, and a description of the operators. (14)

Q.3.

(a) Auction protocols have been adopted in the multi-agent system community as a means to allow agents find an agreement suitable to all parties. Compare the English auction protocol with the Dutch auction protocol. Your answer should include:

i) A description of the protocol involved
ii) An explanation of the rational strategy for the bidders
iii) Any potential limitations of the protocol.

(9)

(b) Suggest an efficient approach that would allow agents to negotiate with the aim of finding points of agreement for items or tasks that can be characterised by a number of different attributes. (8)

(c) Game theory has been used in a number of domains to model and reason about strategic decision making. Explain the following concepts: a dominant strategy, Nash equilibrium. (8)

Q.4.

(a) Explain briefly the importance of *explainability* in artificial intelligence. With reference to an AI paradigm of your choice, outline approaches that have been taken towards providing AI systems with explanations. (8)

(b) Describe, in your own words, what is meant by neuro-evolution. Describe a suitable means to represent a neural network for a neuro-evolution system. (9)

(c) Explain what you would consider to be the main properties of an artificial life system. (8)